

Geophysical Research Abstracts
Vol. 14, EGU2012-11797, 2012
EGU General Assembly 2012
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Water mass renovation in the northeastern Tropical Atlantic

J. Peña-Izquierdo (1), J.L. Pelegrí (1), and E. Mason (2)

(1) Institut de Ciències del Mar, CSIC, Barcelona, Spain, (2) Instituto Mediterráneo de Estudios Avanzados, CSIC, Mallorca, Spain

The highly variable circulation in the northeastern tropical Atlantic is poorly understood. The region is dominated by the Cape Verde Frontal Zone, a dynamic barrier between the southwestward flowing of North Atlantic Central Water (NACW) and the stagnant and weakly ventilated area laid south and occupied by South Atlantic Central Water (SACW). This southern area, also called Shadow Zone, displays minimum values of oxygen content. In this study we use data from an hydrographic (CTD-O₂-ADCP) section forming a closed volume located in the northern part of the Shadow Zone (nSZ). Our objective is to quantify the mass and oxygen fluxes in order to explore how water mass renovation takes place. The results of a ROMS numerical model simulation are used to analyse the seasonal variability. A cyclonic circulation of some 5-7 Sv is observed between the Cape Verde Archipelago and the African continent, distinguishing 2.8 Sv flowing northward along the slope as the Poleward Undercurrent (PUC). We find substantial water mass exchange across the whole frontal zone, with 1.7 Sv of SACW surpassing 24°N along the slope. We explore the significance of the abrupt thermohaline transition typically observed at sigma 26.8, characterized by a salinity minimum, and its relation with the absolute oxygen minimum located at density levels just below. Our results suggest that this salinity minimum coincides with the deepest extent of the tropical zonal jets, thus preventing the direct renovation of the underlying waters.